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Additional Opisthobranch Mollusks from Oregon, with a Review of Deep-Water Records and Observations on the Fauna of the South Coast

by

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Abstract. New and previously overlooked records add 16 species to the list of benthic opisthobranchs known from Oregon, bringing to 83 the total known. The ranges of *Acanthodoris rhodoceras, Cuthona lagunae, Pleurobranchaea californica,* and *Tenellia adspersa* are extended northward, and those of *Colga pacifica* and *Dendronotus albopunctatus* southward. Deep-water records are reviewed; 18 species, including *Colga pacifica, Bathydoris* sp., and *Chlamylla* sp., have been reported from Oregon waters as deep as 3000 m.

The systematics and occurrence of a few species previously reported from Oregon are reviewed and updated. *Melibe leonina,* not reported from the state since the mid-19th century, was recently observed in Yaquina Bay. The presence of *Aldisa sanguinea* in Oregon is confirmed, and one species, reported previously as the opisthobranch *Pleurobranchus* sp., was determined to be the prosobranch *Marsenina* sp.

Intertidal opisthobranchs were examined at three sites on the Oregon coast south of Cape Arago. Forty-three species were observed, including 41 from a 40 × 80 m area at Boardman State Park. The latter site, with its rough topography, numerous small caves, and abundance of seastars, supports one of the most diverse opisthobranch faunas known on the Oregon coast.

INTRODUCTION

GODDARD (1984) attempted to list all of the benthic opisthobranchs known from Oregon. Since then, only *Aplysia californica* Cooper, 1863, has been added to the fauna (PEARCY *et al.,* 1985; PEARCY & SCHOENER, 1987). The present paper describes new records, reports on the rich and previously undocumented opisthobranch fauna of the Oregon coast south of Cape Arago, and reviews deep-water records (most of which come from previously overlooked references). To further update GODDARD (1984), notes are presented on the systematics and occurrence of a few species already recorded from the state.

Owing to the presence of some less familiar genera, the deep-water species are listed systematically; otherwise, species are arranged alphabetically. Collecting sites are shown in Figure 1 and are listed with their latitude and longitude in Table 1.

Species Not Previously Recorded from Oregon

An asterisk (*) before a species name indicates an extension of known geographic range; ranges are given only for those species so marked.

**Acanthodoris rhodoceras* Cockerell *in* Cockerell & Eliot, 1905

Cape Arago, Oregon (mouth of Humboldt Bay, California; JAECKLE, 1984) to Punta Cono, Baja California, Mexico (BERTSCH & AGUILAR ROSAS, 1984).

One specimen, 16 mm long, was found feeding on the encrusting ctenostomatous bryozoan *Alcyonidium* sp. on the underside of a boulder (approximately +0.3 m tide level) at North Cove, Cape Arago on 12 April 1987.

Acteocina harpa (Dall, 1871)

A single specimen of this minute bullomorph was found crawling on algae in a low intertidal pool at North Cove, Cape Arago, on 18 July 1985. The shell measured 4 mm in length.

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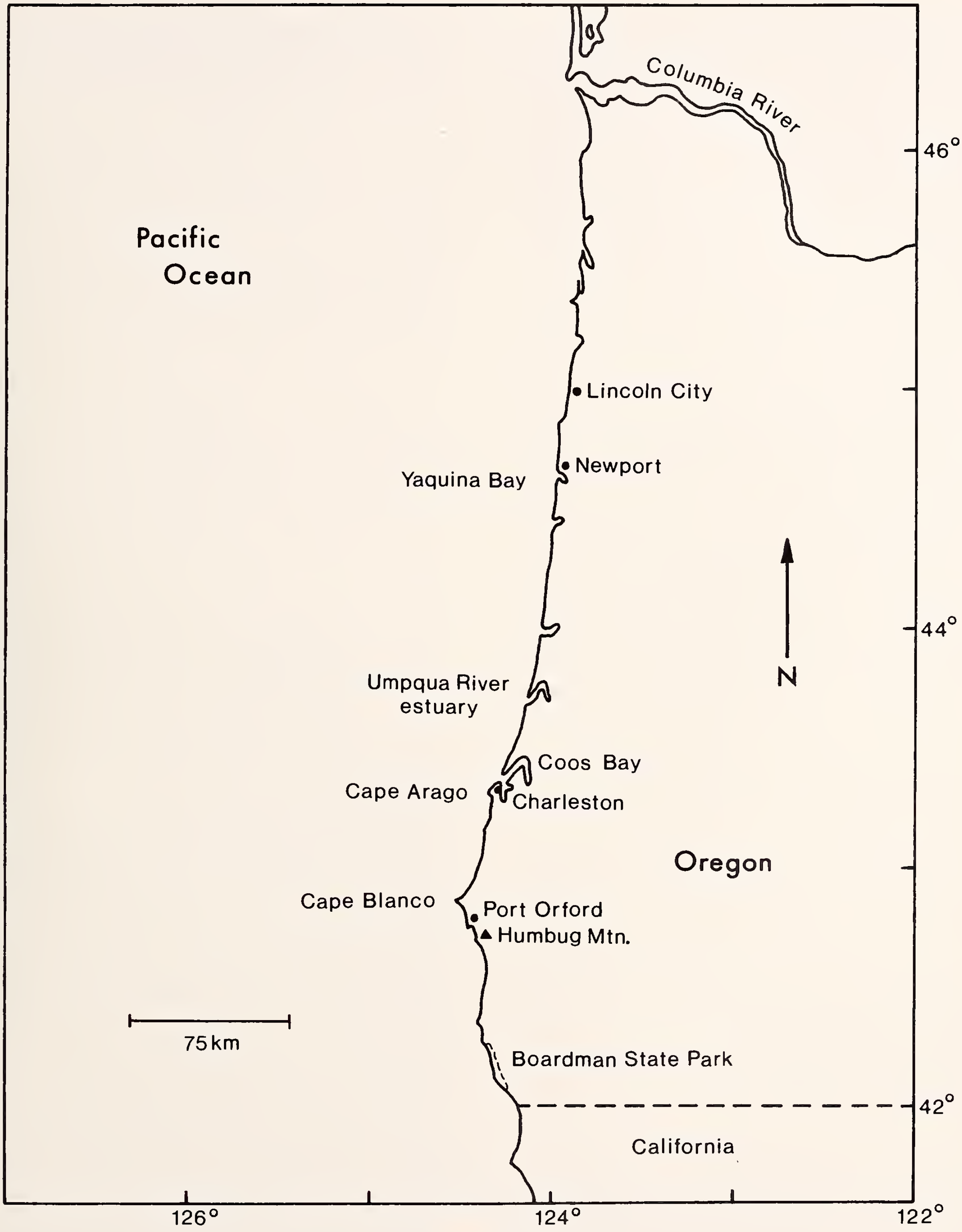

Figure 1

Map of Oregon showing the location of some of the collecting sites.

Table 1

Location of collecting sites along the coast of Oregon.

Site	Latitude N	Longitude W
Mouth of the Columbia River	46°15′	124°00′
Yaquina Bay	44°37′	124°02′
Mouth of the Umpqua River	43°40′	124°11′
Charleston	43°20′	124°19′
Cape Arago	43°20′	124°22′
Cape Blanco	42°50′	124°33′
Port Orford	42°44′	124°29′
North end of Humbug Mountain State Park	42°42′	124°27′
North end of Boardman State Park	42°13′	124°22′

**Cuthona lagunae* (O'Donoghue, 1926)

North end of Boardman State Park, Curry County, Oregon (Palmer's Point, California; JAECKLE, 1984) to Punta Cabras, Mexico (Hamann, 1981, cited by BEHRENS, 1984:66).

Three individuals were observed at the north end of Boardman State Park on 11 July 1987; one of these was on the hydroid *Sertularella* sp. Despite good conditions and careful searching, *Cuthona lagunae* was not found during three other trips made between 1985 and 1989 to the same site at about the same time of year (see below, Observations on the Intertidal Opisthobranchs of Southern Oregon) and thus may be considered sporadic in occurrence there.

**Dendronotus albopunctatus* Robilliard, 1972

Charleston boat basin, Coos Bay, Oregon, and San Juan Islands, Washington. Previously known only from the San Juan Islands, Washington (ROBILLIARD, 1972).

One specimen, 28 mm long, was found at a depth of 2 m on a muddy bottom in the Charleston inner boat basin by Wendy Lou Manley on 11 April 1986.

Dendronotus albus MacFarland, 1966

Since 1983 I have found nine individuals, ranging in length from 2 to 25 mm, at Middle Cove, Cape Arago, and a single specimen at Boardman State Park. Most were found on the same hydroid species, *Abietinaria* sp., eaten by *Doto amyra* Marcus, 1961 (GODDARD, 1984). The identity of the minute specimens was confirmed after rearing them on this hydroid in the laboratory for a few weeks.

Dendronotus diversicolor Robilliard, 1970

One specimen, 33 mm long, of the white form of this species was observed in the low intertidal zone at the north end of Boardman State Park on 7 May 1989.

Doridella steinbergae (Lance, 1962)

Four specimens, 2–3 mm long, were found on 7 September 1989 feeding on colonies of the bryozoan *Membranipora membranacea* that were growing on *Laminaria* sp. hanging from floating docks in Yaquina Bay. Despite careful searching, *Doridella steinbergae* has not been found on *M. membranacea* collected from Coos Bay during the past few summers and autumns.

**Pleurobranchaea californica* MacFarland, 1966

Port Orford, Oregon (near mouth of Klamath River, California; CHIVERS, 1967) to San Diego, California (CHIVERS, 1967).

One specimen, 220 mm long, was taken on 25 January 1985 from a commercial crab pot in waters about 35 m deep near Port Orford and delivered to the Oregon Institute of Marine Biology by Dale Bures.

**Tenellia adspersa* (Nordmann, 1845)

Coos Bay, Oregon (San Francisco Bay, California; STEINBERG, 1963) to Long Beach Harbor, California (CARLTON, 1979); and a global distribution, caused, at least in part, by introductions via shipping (ROGINSKAYA, 1970; CARLTON, 1979; THOMPSON & BROWN, 1984).

Numerous individuals and egg masses were found among the basal stolons of the hydrozoan *Tubularia crocea* from upper Coos Bay in August 1986 and August 1987. The egg masses, short-term lecithotrophic veliger larvae, and newly metamorphosed juveniles all closely matched those described and depicted by RASMUSSEN (1944).

Tenellia adspersa was probably introduced (via shipping) to Coos Bay (J. T. Carlton, personal communication).

Notes on Species Previously Recorded from Oregon

Aldisa sanguinea (Cooper, 1863)

Aldisa sanguinea usually possesses one or two dark spots on the midline of the dorsum between the rhinophores and the branchial plumes (McDONALD & NYBAKKEN, 1980; BEHRENS, 1980). All specimens previously reported from Oregon have lacked these spots (SOWELL, 1949; GODDARD, 1984), raising some question about their specific identity (GODDARD, 1984:145–146). Since 1983 I have observed over 18 individuals of *A. sanguinea,* many with one or two of these spots, at Good Witch, Middle, and North coves of Cape Arago.

Melibe leonina (Gould, 1852)

As described by SPHON (1972), the first record of *Melibe leonina* in Oregon (and, indeed, the first record of any species of opisthobranch from Oregon) was that of CARPENTER (1857). Apparently no records of this species in Oregon have been published since.

Numerous specimens of *Melibe leonina,* up to 60 mm long, were observed by Sarah Fryer and Robert Oswald on the sides of floating docks at Newport on Yaquina Bay on 9 October 1988. I maintained four of these in flow-through aquaria, where they laid egg masses a few centimeters in length similar to those described by HURST

(1967). However, the egg capsules in these egg masses contained 1–5 eggs, whereas HURST (1967:259) noted "15 to 25" eggs per capsule and "as few as 5." Small planktotrophic veligers hatched from one egg mass in 7–8 days at 12–15°C.

Marsenina sp.

SPHON (1972) reported a single specimen of "*Pleurobranchus* sp." that GODDARD (1984:Table 3) listed as a questionable species, owing to the lack of specific identification and its possible identity as *Berthella californica* (Dall, 1900) (which is known to occur at Cape Arago). Examination of Sphon's original specimen (Catalogue No. A.7066, Invertebrate Section, Natural History Museum of Los Angeles County) revealed it to be the lamellariid prosobranch *Marsenina* sp.

Tritonia diomedea Bergh, 1894

This species was erroneously listed as occurring at Cape Arago in GODDARD (1984:Table 3). In Oregon *Tritonia diomedea* has been collected from deep waters only (THOMPSON, 1971; MCCAULEY, 1972; PEREYRA & ALTON, 1972; and see below).

Deep-Water Records

In reviewing the benthic opisthobranchs known from Oregon, GODDARD (1984) overlooked four references containing significant records of opisthobranchs from the continental shelf, continental slope, and abyssal plain off Oregon. These references contain most of our knowledge about deep-water opisthobranchs off the coast of Oregon.

MCCAULEY (1972) summarized deep-water collections of epifaunal invertebrates from off the Oregon coast, including five species of nudibranchs from depths ranging from 25 to 3000 m. Specific collecting localities were not described. PEREYRA & ALTON (1972) reported eight species of opisthobranchs among samples of benthic invertebrates in depths ranging from 91 to 2103 m along a transect line extending south by southwest from the mouth of the Columbia River. BERTRAND (1971) found three species of cephalaspideans in his study of the infauna of the central Oregon continental shelf, between the mouth of the Umpqua River and Yaquina Bay (see Figure 1) in depths ranging from 75 to 450 m. RICHARDSON *et al.* (1977) collected eight species of opisthobranchs from depths of 10 to 100 m off the mouth of the Columbia River.

To my knowledge, only two other studies mention deep-water opisthobranchs from Oregon. THOMPSON (1971) examined five specimens of *Tritonia diomedea* (as *T. exsulans*) collected from 1000 to 1260 m "off the Oregon coast." These specimens were collected by personnel aboard Oregon State University research vessels from depths virtually identical to those given for this species by MCCAULEY (1972) and thus are probably the same as those reported by McCauley. BELCIK (1975) examined collections in the Department of Oceanography at Oregon State University and reported three species of nudibranchs from deep water. These were included in GODDARD's (1984) list of benthic opisthobranchs from Oregon. The specimens of *Bathydoris* sp. and *Tritonia* sp. documented by Belcik appear to be the same as those listed by MCCAULEY (1972).

Twenty species of opisthobranchs were found in the above studies in depths ranging from 10 to 3000 m. The 18 species identified at least to the level of order, and the depths at which they were collected, are listed in Table 2. In addition to providing significant bathymetric data, these records add seven species to the list of Oregon opisthobranchs compiled by GODDARD (1984:Table 3) and include one extension of known geographic range (see below).

PEREYRA & ALTON's (1972) record of *Colga pacifica* (as *Issena pacifica*) is the only record of this distinctive species in the northern Pacific since Bergh's description of the type specimen from 79 m near Unimak Island, Alaska (O'DONOGHUE, 1926; LEE & FOSTER, 1985). The species' geographic range (not discussed by PEREYRA & ALTON, 1972) is thus extended southeastward by approximately 2900 km. Pereyra and Alton's specimens of opisthobranchs were examined by Henning Lemche, and given Lemche's experience with specimens of *C. pacifica* from the North Atlantic (see JUST & EDMUNDS, 1985:60–61; PLATTS, 1985), the record is probably valid.

To my knowledge, the genus *Chlamylla* (see Table 2) has not been reported previously from the eastern Pacific. However, the taxonomic status of *Chlamylla* is unclear, and further work may reveal it to be a junior synonym of *Flabellina,* a genus well represented in the eastern Pacific (see MILLER, 1971:313; KUZIRIAN, 1978).

Observations on the Intertidal Opisthobranchs of Southern Oregon

Except for a single record of *Cuthona cocoachroma* from Cape Blanco (GODDARD, 1984:148), there are no previous records of opisthobranchs from the Oregon coast south of Cape Arago. Three rocky intertidal areas on this part of the coast were examined for benthic opisthobranchs between 1982 and 1989.

Cape Blanco: Cape Blanco is a low-elevation, exposed rocky headland with an intertidal zone dominated by wave-cut rock shelves, large boulders, and a few rock stacks. Long sandy beaches lie to the north and south. Two trips were made, one on 26 April 1982, the other on 19 August 1986.

Humbug Mountain State Park: Two wave-exposed boulder fields located between Rocky Point and Coal Point and just inside the north boundary of Humbug Mountain State Park were examined during a minus tide on 15 May 1987. Most of the boulders were partially buried in sand, limiting the amount of suitable habitat for opisthobranchs and their prey.

Boardman State Park: The study area measured approximately 40 × 80 m and was located in the low inter-

Table 2

Benthic opisthobranch mollusks collected from deep water off the coast of Oregon. Only species identified at least to the level of order are listed, and recent nomenclatural changes are incorporated. A plus sign (+) indicates a species not included in Goddard's (1984) list of benthic opisthobranchs from Oregon.

Species	Depth range, meters[1]	Reference[2]
Order CEPHALASPIDEA		
Family Acteonidae		
+*Rictaxis punctocaelatus* (Carpenter, 1864)	(75–450)	3
Family Cylichnidae		
+*Acteocina culcitella* (Gould, 1852)	366	2, 3
+?*Acteocina* sp.	(10–100)	4
+*Cylichna attonsa* (Carpenter, 1864)	(10–450)	3, 4
Family Gastropteridae		
+*Gastropteron pacificum* Bergh, 1894	(10–100)	4
Family Aglajidae		
Melanochlamys diomedea (Bergh, 1894)	(10–100)	4
Order NOTASPIDEA		
Family Pleurobranchaeidae		
+*Pleurobranchaea californica* MacFarland, 1966	35	present study
Order NUDIBRANCHIA		
Suborder DENDRONOTACEA		
Family Tritoniidae		
Tritonia diomedea Bergh, 1894	640–1260	1, 2
Tritonia sp.	200–2086	1, 5
Tochuina tetraquetra (Pallas, 1788)	54	5
Suborder DORIDACEA		
Family Bathydorididae		
Bathydoris sp.	2709–3000	1, 5
Family Polyceridae		
+*Colga pacifica* Bergh, 1894 (as *Issena pacifica* Iredale & O'Donoghue, 1923)	247	2
Family Archidorididae		
Archidoris montereyensis (Cooper, 1863)	100	1
Unidentified dorid	247	2
Unidentified dorid	(10–100)	4
Suborder ARMINACEA		
Family Arminidae		
Armina californica (Cooper, 1863)	25–200	1, 2, 4
Armina sp.	91	2
Suborder AEOLIDACEA		
Family Flabellinidae		
+*Chlamylla* sp.	777	2

[1] If the depth range of a species was not available, then the depth range of the study (or combined ranges of more than one study) is given in parentheses.

[2] 1, McCauley (1972); 2, Pereyra & Alton (1972); 3, Bertrand (1971); 4, Richardson *et al.* (1977); 5, Belcik (1975).

tidal zone 1.2 km north of the mouth of Houstenader Creek at the north end of Boardman State Park (42°13′22″N, 124°22′55″W). Although most of the neighboring shore is fully exposed to ocean swells, the study area is protected by outer rocks and a tall rock stack. Its topography is rough and irregular, consisting of large boulders, rock ridges, and tidepools and channels of variable depth. Small caves and overhangs, lined with luxuriant communities of sessile invertebrates, are numerous. Sea urchins were scarce. Five trips, four during minus tides, were made to this site on the following dates: 2 July 1985, 11 July 1987, 17 July 1988, 11 October 1988 (not a minus tide), and 7 May 1989.

A total of 43 species of opisthobranchs were found on the southern Oregon coast, and 41 of these occurred at Boardman State Park alone (Table 3). Seventeen species were observed at each of the other localities. All but two of the 43 species were nudibranchs.

Table 3

Opisthobranchs observed intertidally on the coast of Oregon south of Cape Arago, 1982–1989.

	Locality[1]		
Species	Boardman State Park	Humbug Mountain State Park	Cape Blanco
Acanthodoris hudsoni MacFarland, 1905	X		
Acanthodoris nanaimoensis O'Donoghue, 1921	X		X
Aeolidia papillosa (Linnaeus, 1761)	X		
Aldisa sanguinea (Cooper, 1863)	X		
Ancula pacifica MacFarland, 1905	X	X	
Anisodoris nobilis (MacFarland, 1905)	X		
Archidoris montereyensis (Cooper, 1863)	X	X	X
Cadlina marginata MacFarland, 1905	X		X
Cadlina modesta MacFarland, 1966	X		
Catriona columbiana (O'Donoghue, 1922)	X	X	X
Cuthona abronia (MacFarland, 1966)		X	
Cuthona albocrusta (MacFarland, 1966)	X	X	
Cuthona cocoachroma Williams & Gosliner, 1979		X	X
Cuthona divae (Marcus, 1961)	X	X	X
Cuthona flavovulta (MacFarland, 1966)	X		
Cuthona fulgens (MacFarland, 1966)	X	X	
Cuthona lagunae (O'Donoghue, 1926)	X		
Dendronotus albus MacFarland, 1966	X		
Dendronotus diversicolor Robilliard, 1970	X		
Dendronotus frondosus (Ascanius, 1774)	X	X	X
Dendronotus subramosus MacFarland, 1966	X		
Diaphana californica Dall, 1919	X		
Diaphorodoris lirulatocauda Millen, 1985	X		
Dirona albolineata Cockerell & Eliot, 1905	X		X
Dirona picta MacFarland *in* Cockerell & Eliot, 1905	X		
Discodoris heathi MacFarland, 1905	X		
Discodoris sandiegensis (Cooper, 1863)	X	X	X
Doto amyra Marcus, 1961	X	X	X
Doto columbiana O'Donoghue, 1921	X		X
Doto kya Marcus, 1961	X		
Eubranchus olivaceus (O'Donoghue, 1922)	X	X	
Eubranchus rustyus (Marcus, 1961)	X		
Flabellina trilineata (O'Donoghue, 1921)	X	X	X
Hallaxa chani Gosliner & Williams, 1975	X		
Hermissenda crassicornis (Eschscholtz, 1831)	X	X	X
Janolus fuscus O'Donoghue, 1924	X	X	X
Laila cockerelli MacFarland, 1905	X		
Onchidoris muricata (Müller, 1776)	X		
Placida dendritica (Alder & Hancock, 1843)	X		
Rostanga pulchra MacFarland, 1905	X	X	X
Triopha catalinae (Cooper, 1863)	X	X	X
Triopha maculata MacFarland, 1905	X		X
Tritonia festiva (Stearns, 1873)	X		
Number of species per locality	41	17	17

[1] See Figure 1, Table 1, and text for specific localities.

The mean number of species I found (working alone, usually for 3 h) per minus tide at Boardman was 27.2 ($n = 4$; range, 23–30 spp.). The diversity of opisthobranchs observed here compares favorably with that at Middle Cove, Cape Arago, where, in an area of similar size and habitat complexity, I have twice found 29 species on a single low tide and where a total of 42 species have been observed (GODDARD, 1984, and unpublished data). However, this total was reached after 25 trips over an 8-yr period. A similar effort at Boardman would probably reveal even more species. The substratum at Boardman (composed primarily of tough graywacke sandstones dating from the Jurassic [BALDWIN, 1981; personal observations]) is harder and less susceptible to erosion than the Eocene sandstones at Cape Arago and may allow for the establishment of a more mature and complex encrusting community capable of supporting more species of opisthobranchs. In addition, juveniles of the seastars *Solaster dawsoni* and *Pycnopodia helianthoides* were more numerous at Boardman than at Middle Cove (personal observations). In the laboratory both of these species elicit escape re-